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Standard Technique of PTA/stenting for Atherosclerotic Intracranial Arterial Stenosis

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Summary

PTA/stenting for the intracranial arteriosclerotic lesion is effective and novel treatment. Our standard technique to avoid serious complications, such as vessel rupture or acute occlusion was introduced in this paper.

Introduction

Percutaneous transluminal angioplasty and stenting for the atherosclerotic intracranial arterial stenosis is novel and effective treatment to improve the haemodynamic compromise [1-8]. However, serious complications related to the procedure, such as vessel rupture and acute occlusion are possible during the procedure [1-8]. Our standard technique to prevent from these serious complications was introduced.

1) Antiplatelet drug must be administrated at least 1 week before the treatment and the procedure must be performed under systemic heparinization.

2) Introduction of a guiding catheter. It is important to use a guiding catheter with strong support and to introduce it into the distal portion of the cervical ICA or VA. Coaxial system must be used to prevent from embolic complication during guiding catheter introduction. The stability of the guiding catheter is very important to introduce stents across the tortuous curves.

3) Measuring the vessel diameter. The accurate diameter of the artery is important to prevent from vessel rupture or stent migration. We usually use the external marker. If predilatation was performed, the vessel diameter is measured from the size of the dilated balloon. In case of the intracranial vertebral artery stenosis, an intravascular ultrasound is usually available to measure the vessel diameter.

4) Lesion crossing by the guidewire. We usually perform this procedure under road mapping mode with maximum magnification. If strong resistance was felt to cross the stenosis, the guidewire should not be introduced. The guidewire should be advanced to the distal portion of the M2 for intracranial ICA stenosis or PCA in case of vertebrobasilar lesion. The guidewire must be kept in the true lumen until the end of every procedure.

5) PTA. The size of PTA balloon catheter must be same or smaller than the diameter of the normal arterial diameter and the length of the balloon must cover the entire lesion. The balloon should not be inflated over the size of normal vessel diameter. The balloon should be inflated gradually at the rate of 1atm/10 seconds. If the nominal pressure is 6 atm, it takes one minute for the balloon to reach the nominal pressure.

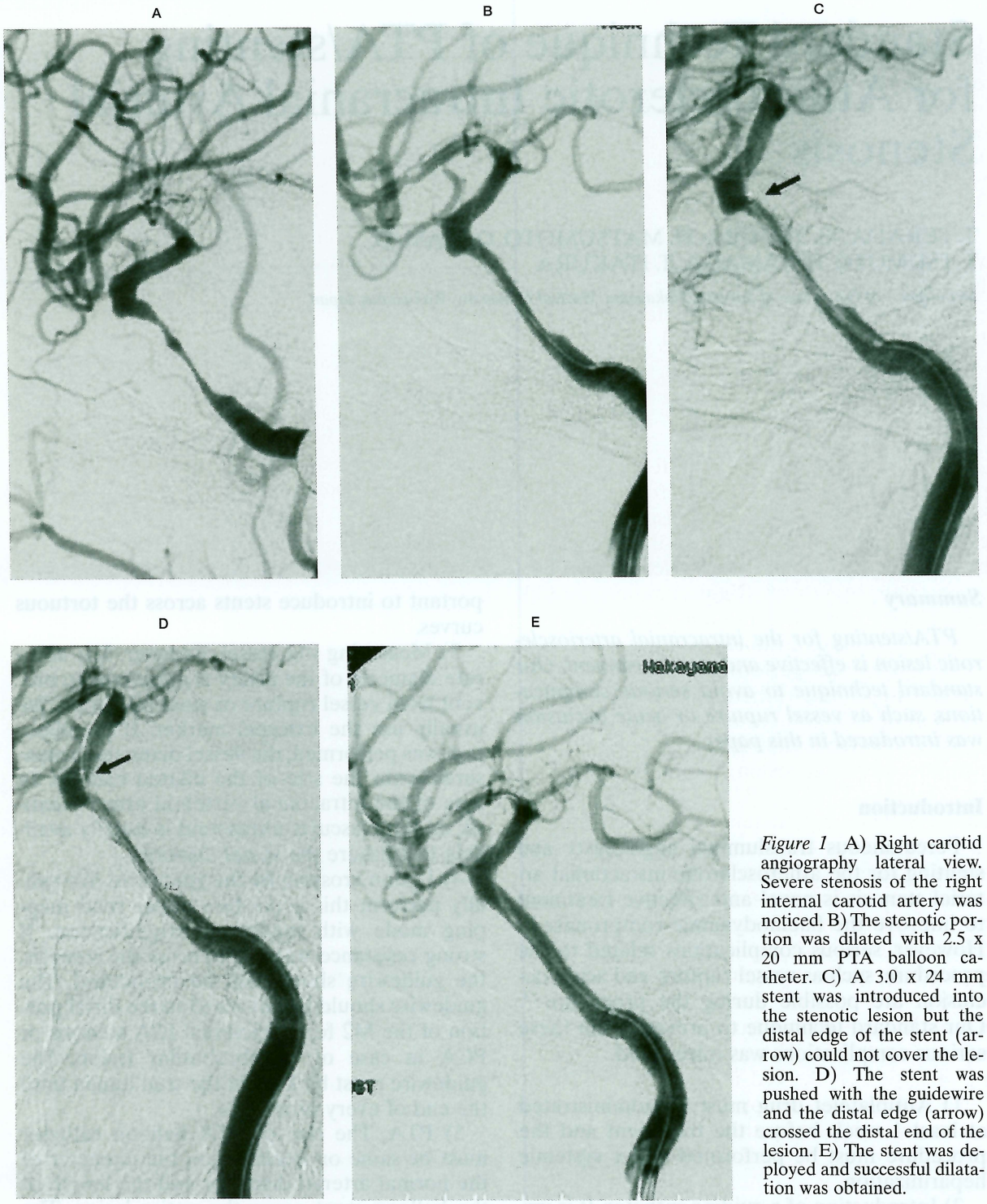

Figure 1 A) Right carotid angiography lateral view. Severe stenosis of the right internal carotid artery was noticed. B) The stenotic portion was dilated with 2.5 x 20 mm PTA balloon catheter. C) A 3.0 x 24 mm stent was introduced into the stenotic lesion but the distal edge of the stent (arrow) could not cover the lesion. D) The stent was pushed with the guidewire and the distal edge (arrow) crossed the distal end of the lesion. E) The stent was deployed and successful dilatation was obtained.

6) Stenting. In case of stenting, the PTA balloon catheter is easily exchanged into stent delivery system by using the magnet exchange system. As for stent, the maximum size of the stent must be larger than the normal vessel diameter and cover the entire lesion. If stent delivery is difficult, another guidewire should be introduced along the stent or the stent should be pushed with the guidewire gently.

Once the stent was delivered into the appro-

priate portion, dry aspiration was performed and inflated gradually like the PTA to the level of normal to 0.15 mm larger than the normal diameter. After inflation of the stent, the balloon was deflated and gently retrieved not to move the stent. Stent should not be deployed if the vessel diameter is smaller than 3.0 mm as a rule.

The PTA balloon should not be inflated beyond the distal edge of the stent, even if the dilatation was insufficient.

7) After confirming the satisfactory dilatation, the guidewire was retrieved.

Representative Case of Intracranial PTA/stenting

A 58-year-old male was admitted to our hospital due to recurrent TIA of left hemiparesis. SPECT using 99mTc-CD demonstrated the decrease of cerebral blood flow in the right cerebral hemisphere with poor reactivity for diamox challenging test. Right common carotid angiogram revealed severe long stenosis of the right petrous to cavernous portion (figure 1A). PTA/stenting was performed via transfemoral route. A 6F guiding catheter was introduced into the internal carotid artery.

A PTA balloon catheter of 2.5 x 20 mm was introduced into the lesion and inflated at 6 atm for 2 minutes (figure 1B). After predilatation, the PTA balloon catheter was exchanged into the stent of 3.0 mm x 24 mm and introduced into the lesion. The stent could not be advanced to the genu of the carotid siphon by the usual method (figure 1C). Then the stent was pushed with guidewire gently and finally reached the appropriate position (figure 1D). The stent was inflated 6 atm for one minute and inflated at 14 atm at the proximal portion of the stent for one minute (figure 1E). TIA was ceased after stenting and SPECT showed remarkable improvement. Restenosis was not demonstrated on the follow-up angiography three months after the treatment.

Possible Complications Related to Intracranial PTA/stenting

1) Thromboembolic complication: Embolic complication is rare in the case of intracranial PTA/stenting. Protection system is usually not necessary. Acute occlusion due to the vessel dissection or acute stent thrombosis is the possible cause of ischemic complication.

2) Haemorrhagic complication: If vessel rupture was caused, the patient is usually fatal. Overdilatation of the balloon should not be done. The avulsion of the small vessel by the stretching of the major artery is also possible complication of bleeding. At the tortuous lesion, PTA/stenting should be avoided. Perforation by the guidewire is possible cause of bleeding. During stent introduction, the tip of the guidewire easily moves. The motion of the guidewire must be monitored during the entire procedure not to cause vessel perforation. Hyperperfusion syndrome is also the cause of bleeding. The evaluation of the cerebral haemodynamic status before the treatment is important. If severe haemodynamic compromise was noticed, strict control of the blood pressure is necessary.

References

1 Connors III JJ, Wojoak JC: Percutaneous transluminal angioplasty for intracranial atherosclerotic lesions: evolution of technique and short-term results. Journal of Neurosurg 91: 415 -423,1999.
2 Higashida RT, Tsai FY et Al: Transluminal angioplasty for atherosclerotic disease of the vertebral and basilar arteries. J Neurosurg 78: 192-198, 1993.
3 Kellogg JX, Nesbit GM et Al: The role of angioplasty in the treatment of cerebrovascualr disease. Neurosurg 43: 549-556, 1998.
4 Mori T, Fukuoka M et Al: Follow-up study after intracranial percutaneous tranaluminal cerebral balloon angioplasty. Am J Neuroradiology 19: 1925-1933, 1998.
5 Terada T, Higashida RT et Al: Transluminal angioplasty for arteriosclerotic disease of the distal vertebral and basilar arteries: J of Neurosurg Psychiat 60: 377-381, 1996.
6 Terada T, Yokote H et Al: Carotid endarterectomy and simultaneous angioplasty for tandem internal carotid stenoses. Neuroradiol 40: 404-408, 1998.
7 Terada T, Tsuura M et Al: Endovascular therapy for stenosis of the petrous or cavernous portion of the internal carotid artery: percutaneous transluminal angioplasty compared with stent placement. J Neurosurg 98: 491-497, 2003.
8 Touho H: Percutaneous transluminal angioplasty in the treatment of atherosclerotic disease of the anterior cerebral circulation and haemodynamic evaluation. J Neurosurg 82: 953-960, 1995.

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